Bell Ringer

1. What physical layer of the Earth makes up all of the crust and the very upper portion of the mantle?

2. The core can be broken up into the inner core and the outer core. What is the difference between them?

3. Why is the core of the Earth mostly metal and not rocky at all?

Earth Structure

How do we know what's inside the Earth?

1. Drill a hole. . . a very deep hole!
2. Examine meteorites.
3. Study magnetic properties.
4. "Listen" to earthquakes.

Drilling a Hole

Ocean drilling program

We have barely scratched the surface of the crust.

- Deepest hole penetrated 2,111 m (1.31 mi)
  Leg 148, E Pacific Ocean
- Shallowest water depth: 37.5 m (123 ft)
  Leg 143, NW Pacific Ocean
- Greatest water depth: 5,980 m (3.72 mi)
  Leg 129, W Pacific Ocean

Direct Observations

- Inclusions in Volcanic Eruptions
  - **Pieces of rock from deep in the Earth are brought up in “hot-liquid-magma” as it rises to the surface**

Inferences from Meteorites

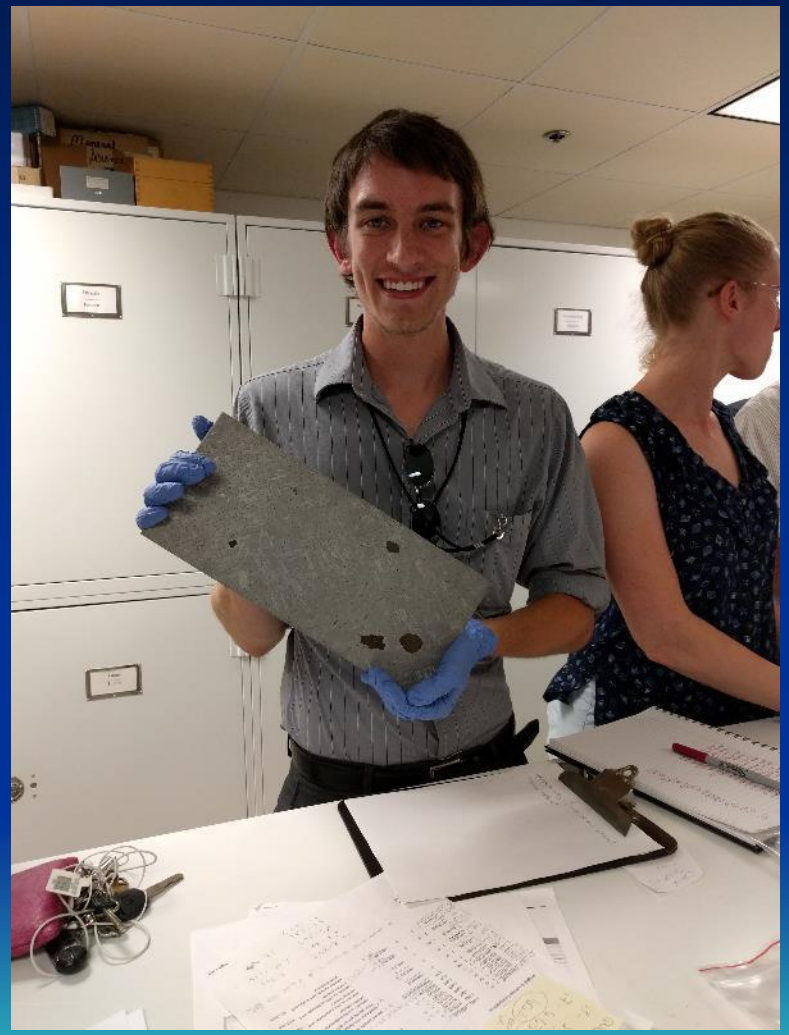
- Stony Chondrite

- Iron

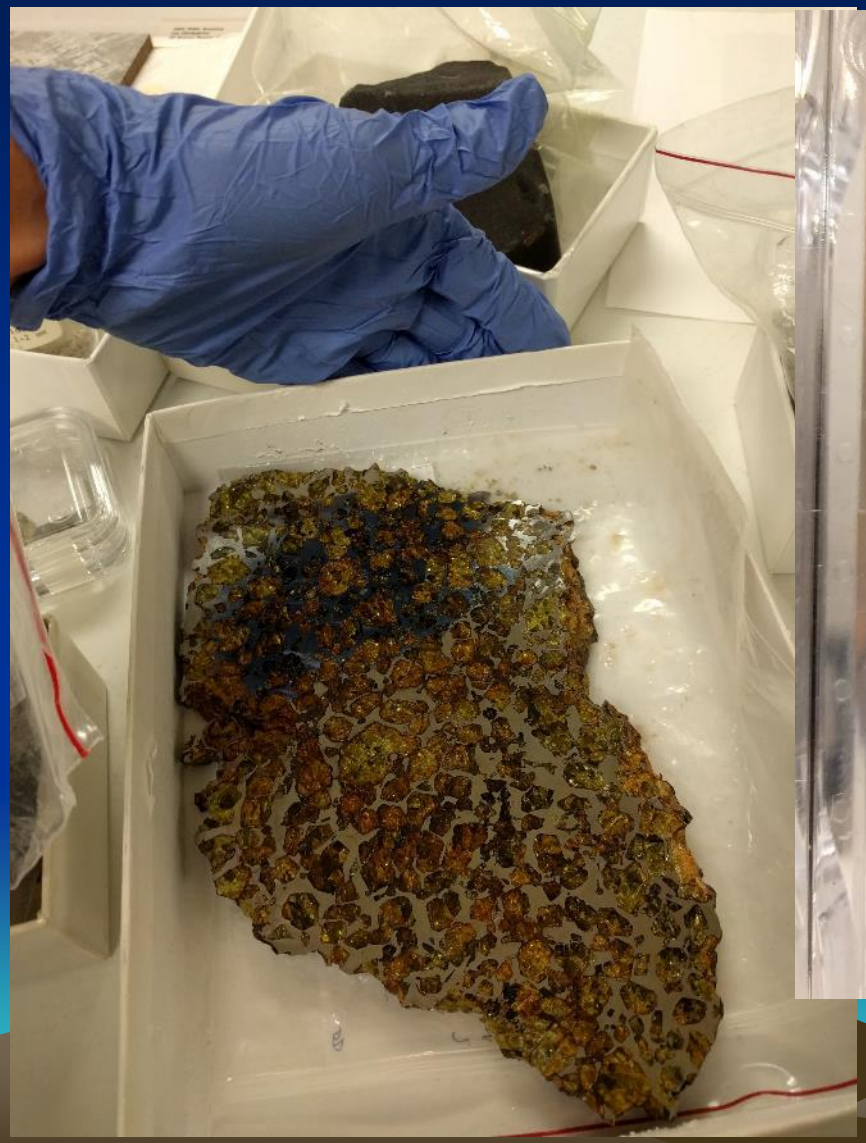
- Stony Achondrite

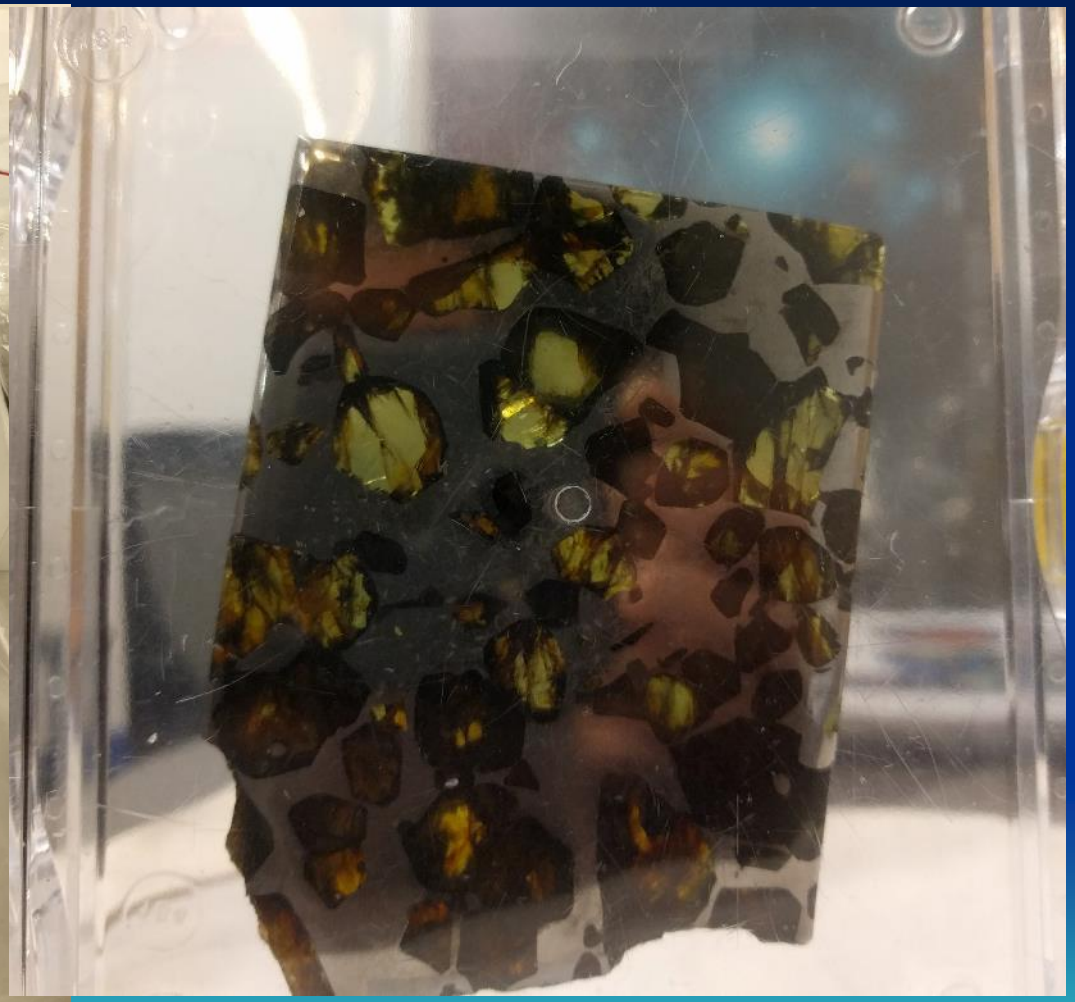
Stony Chondrite

Iron meteorites



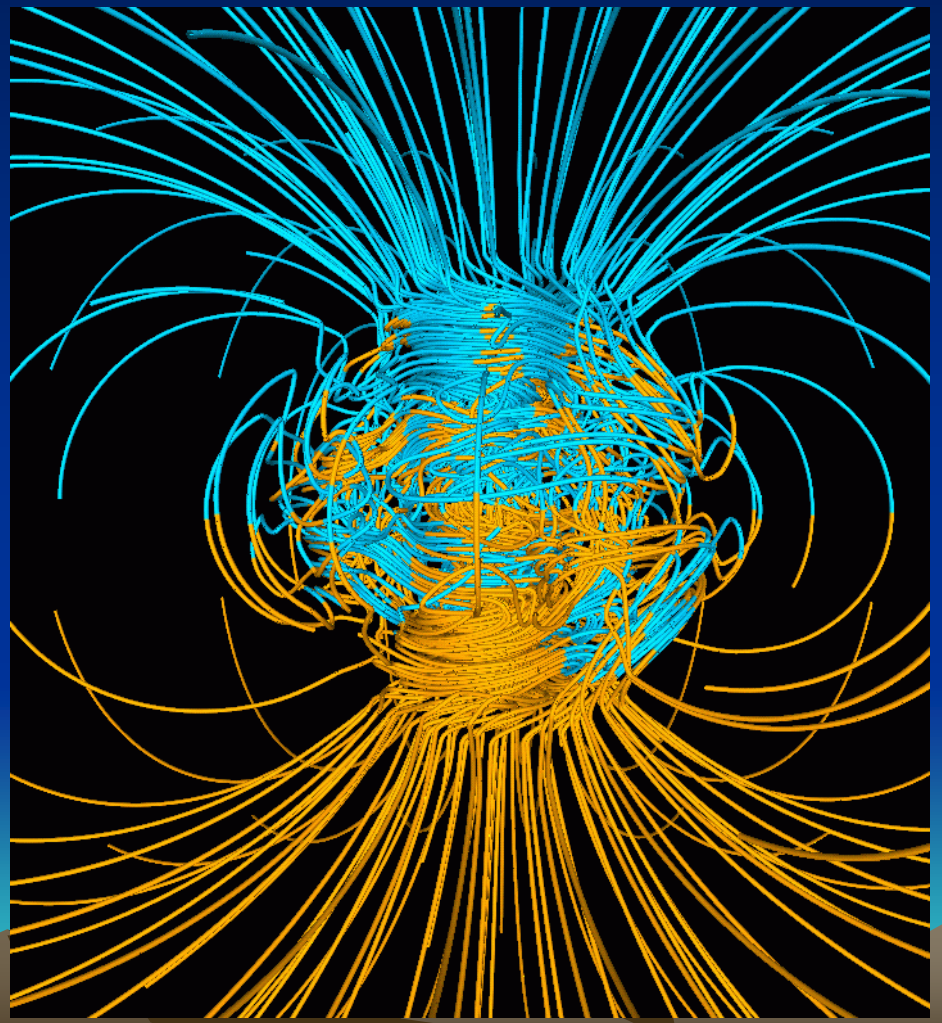
Rocky-Iron





Where would this come from?

Why is a magnetic field created in the outer core? [Lines below represent the field.]

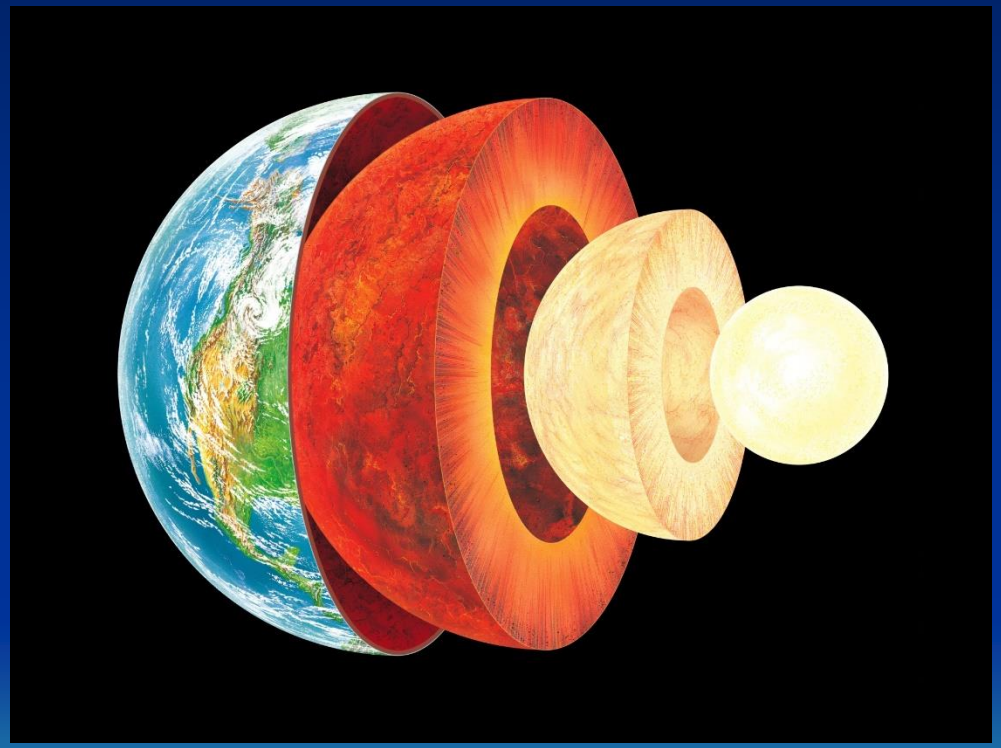


Recipe for a magnetic field.

1. Something that conducts electricity
2. A liquid

What does this tell us about the outer core?

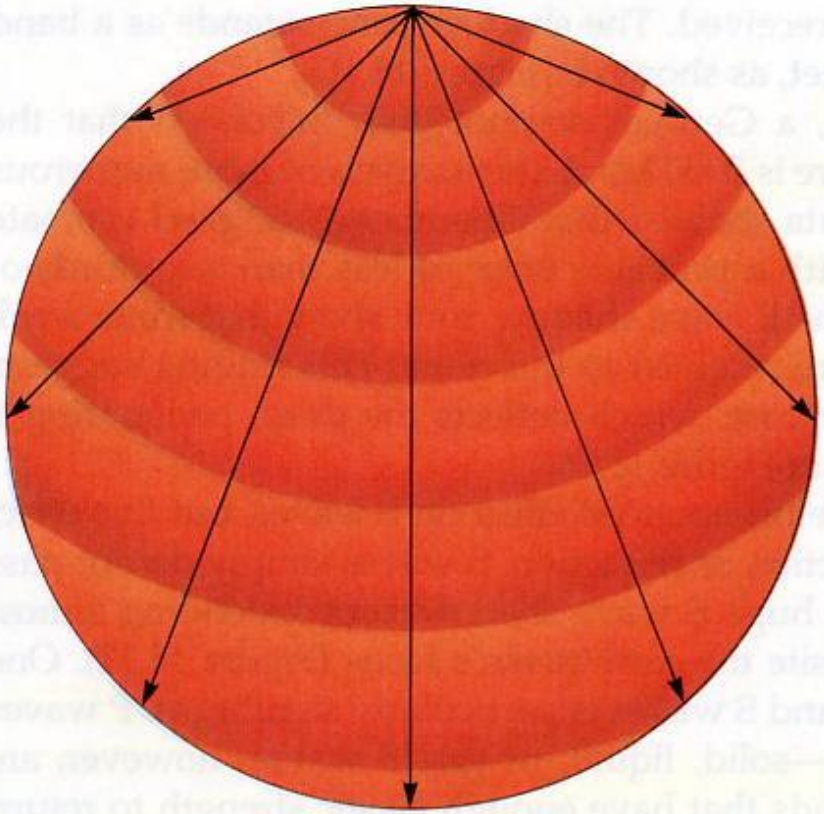
1. It's made of something that conducts electricity (probably iron)
2. It's a liquid



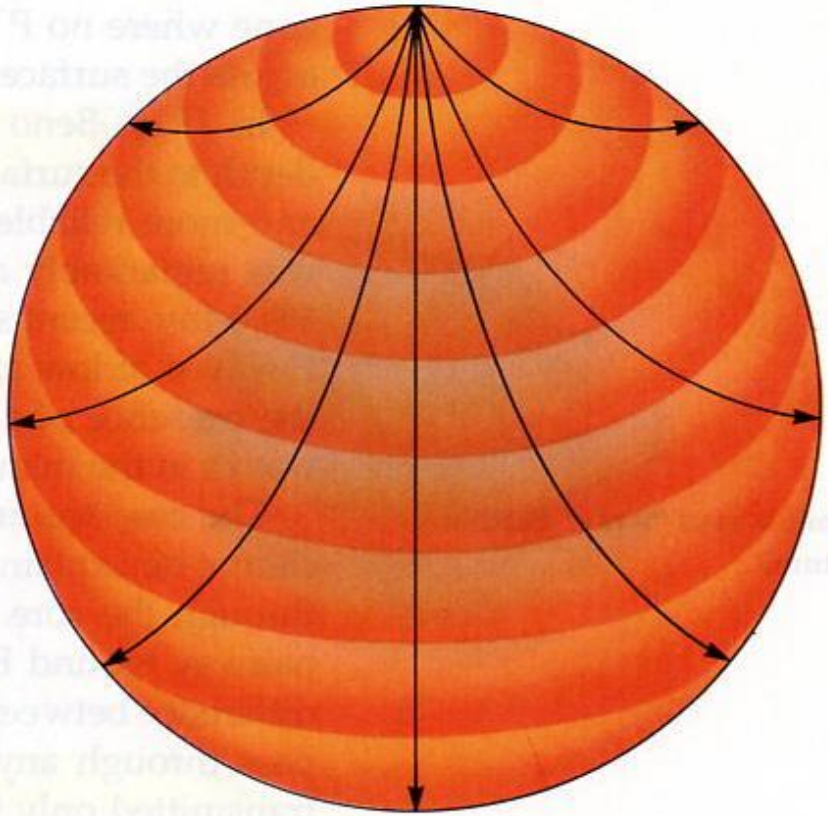
What happens to waves when they move into material that is denser?

They **refract, or bend,** as shown here!

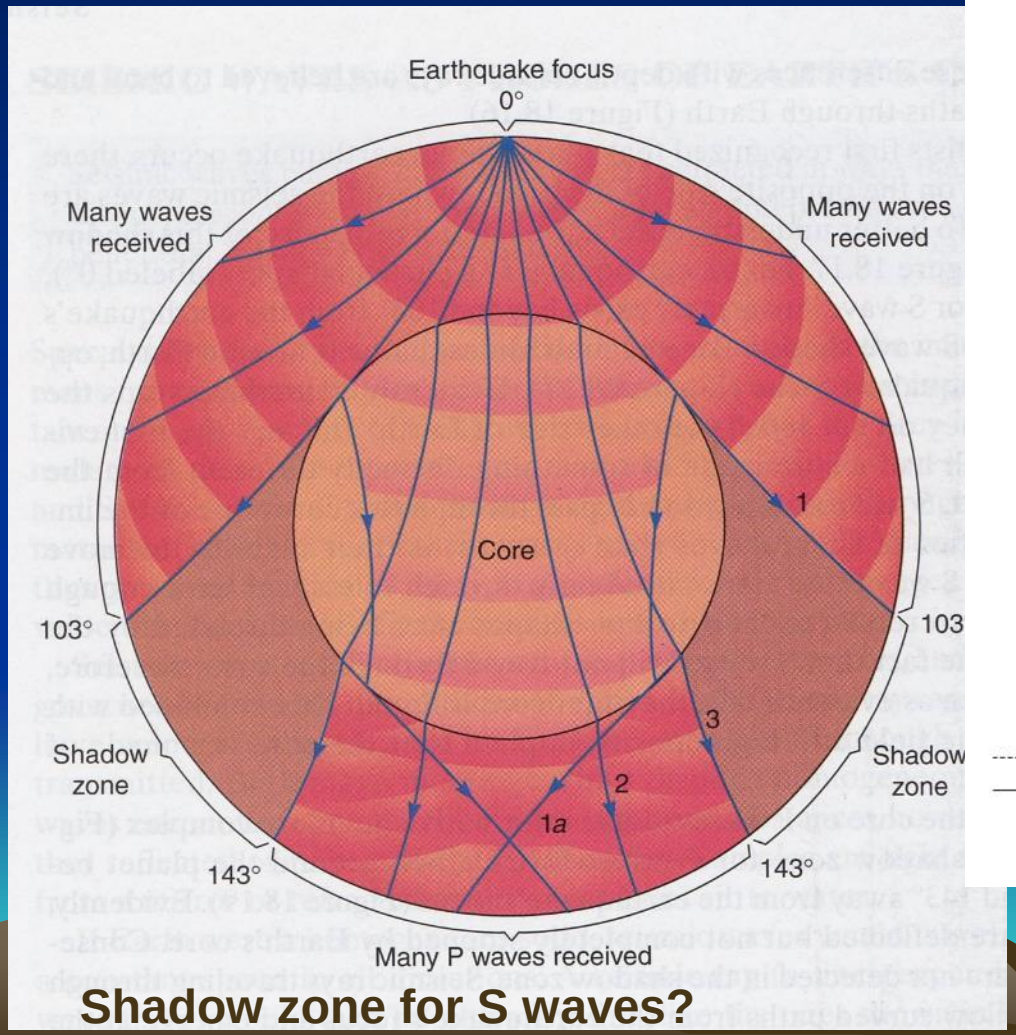
Same density everywhere



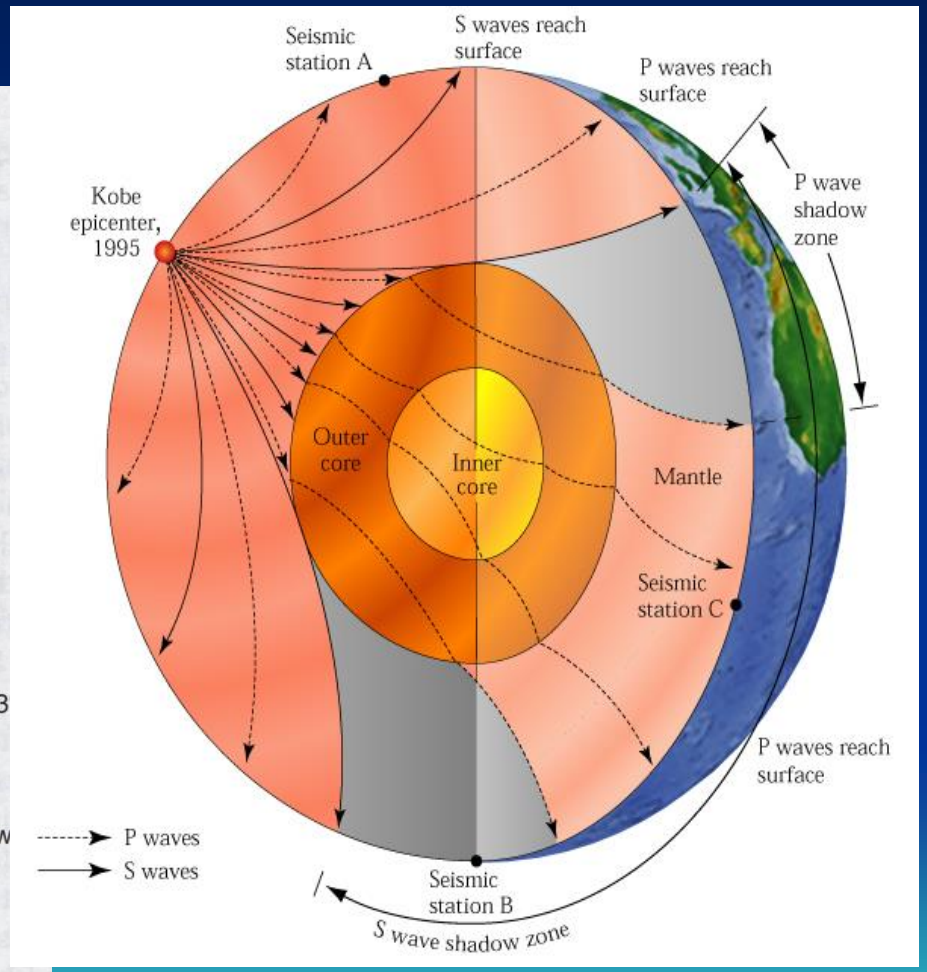
Gradually increasing density



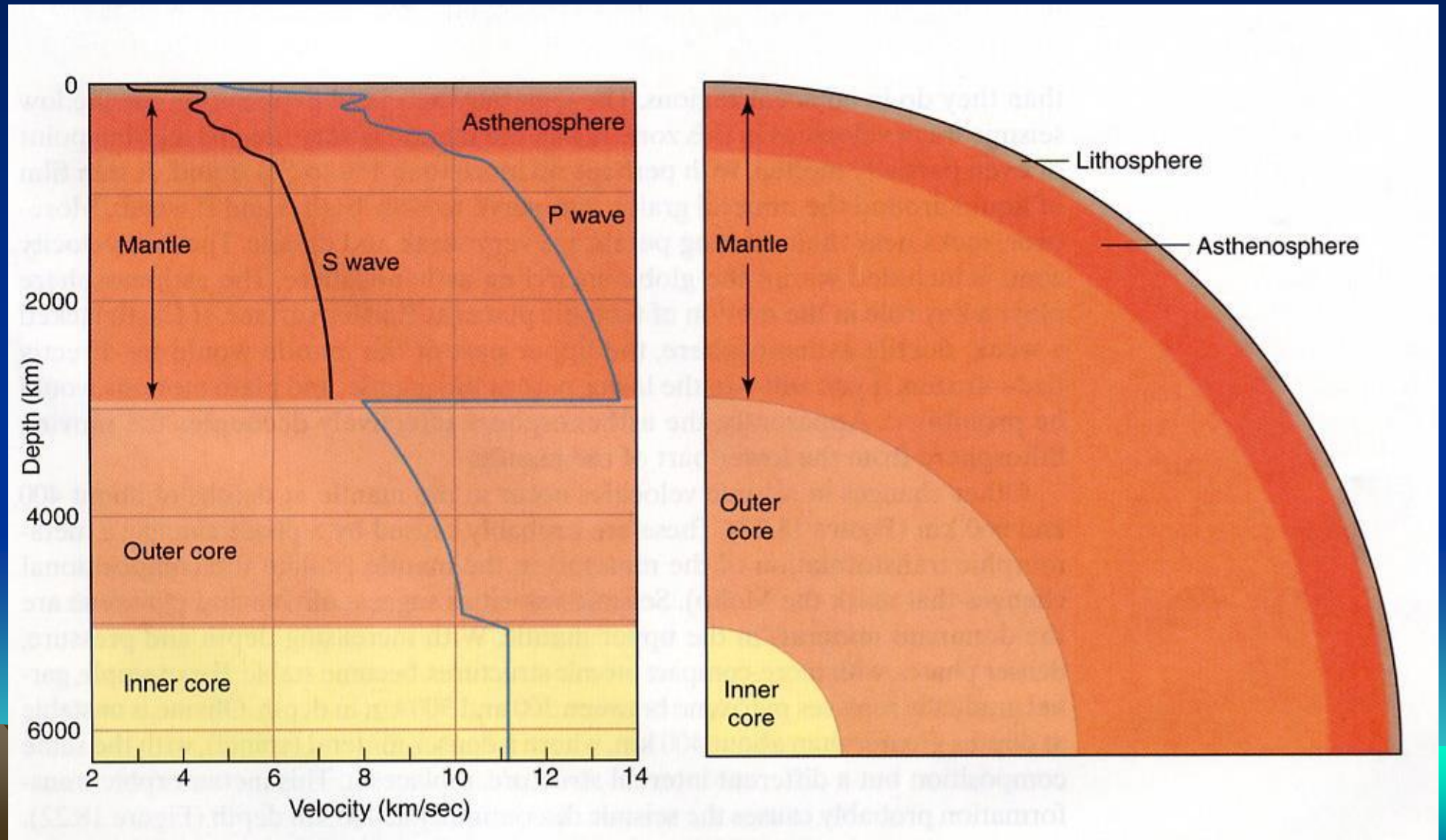
There are sharp changes in the composition of the earth with increasing depth



Shadow zone for S waves?

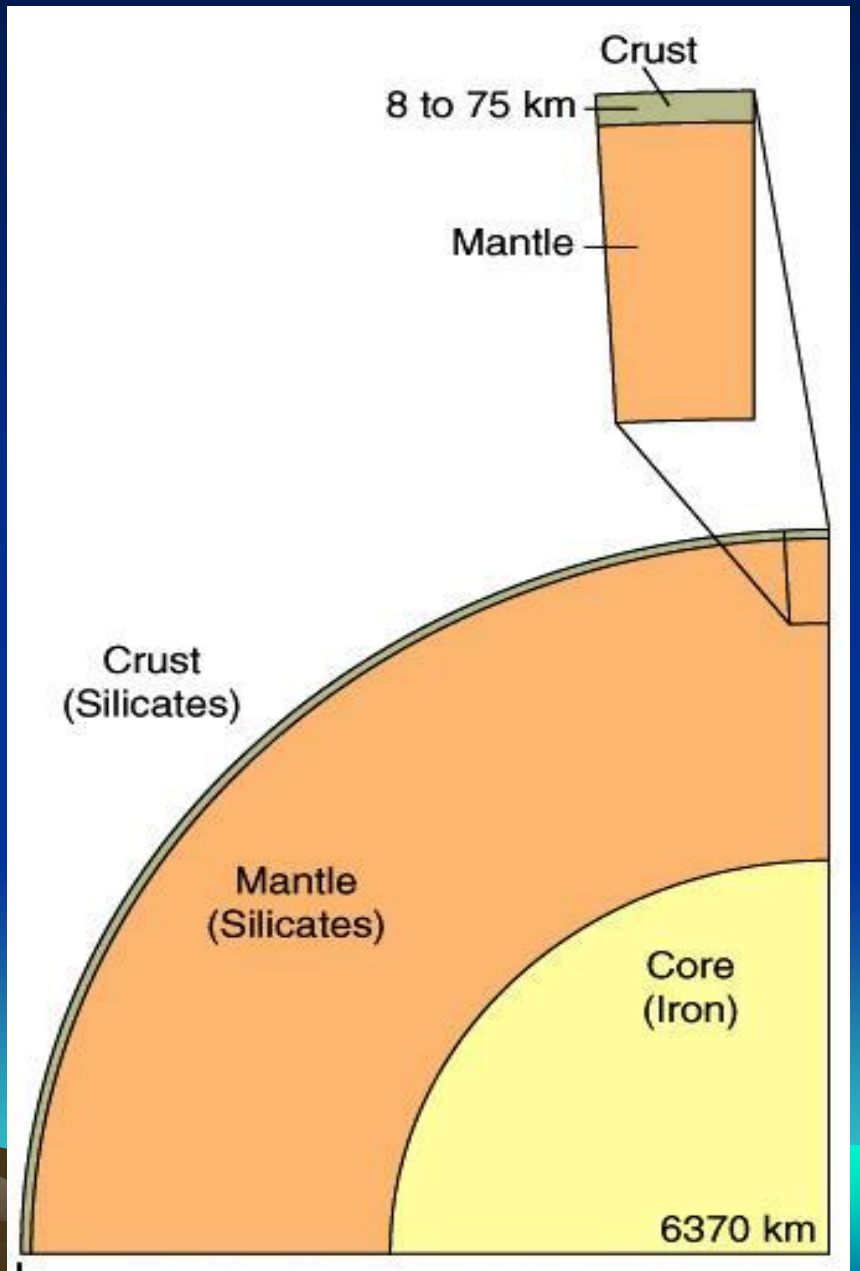


Seismic waves reveal the more complete picture of the earth's deep interior…



Layers of the Earth (Composition)

- **Crust**
  - **2.7 – 3.0 g/cm^3**
  - 5 – 30 km thick
- **Mantle**
  - **3.2 – 5.0 g/cm^3**
  - **2,900 km thick**
- **Core**
  - 10.8 g/cm^3
  - **3,500 km thick**



Layers of the Earth (Physical properties)

Lithosphere

Solid & rigid - 10 km 300 km thick

Asthenosphere

Temperature and pressure combine to allow rock to partially melt

Mesosphere

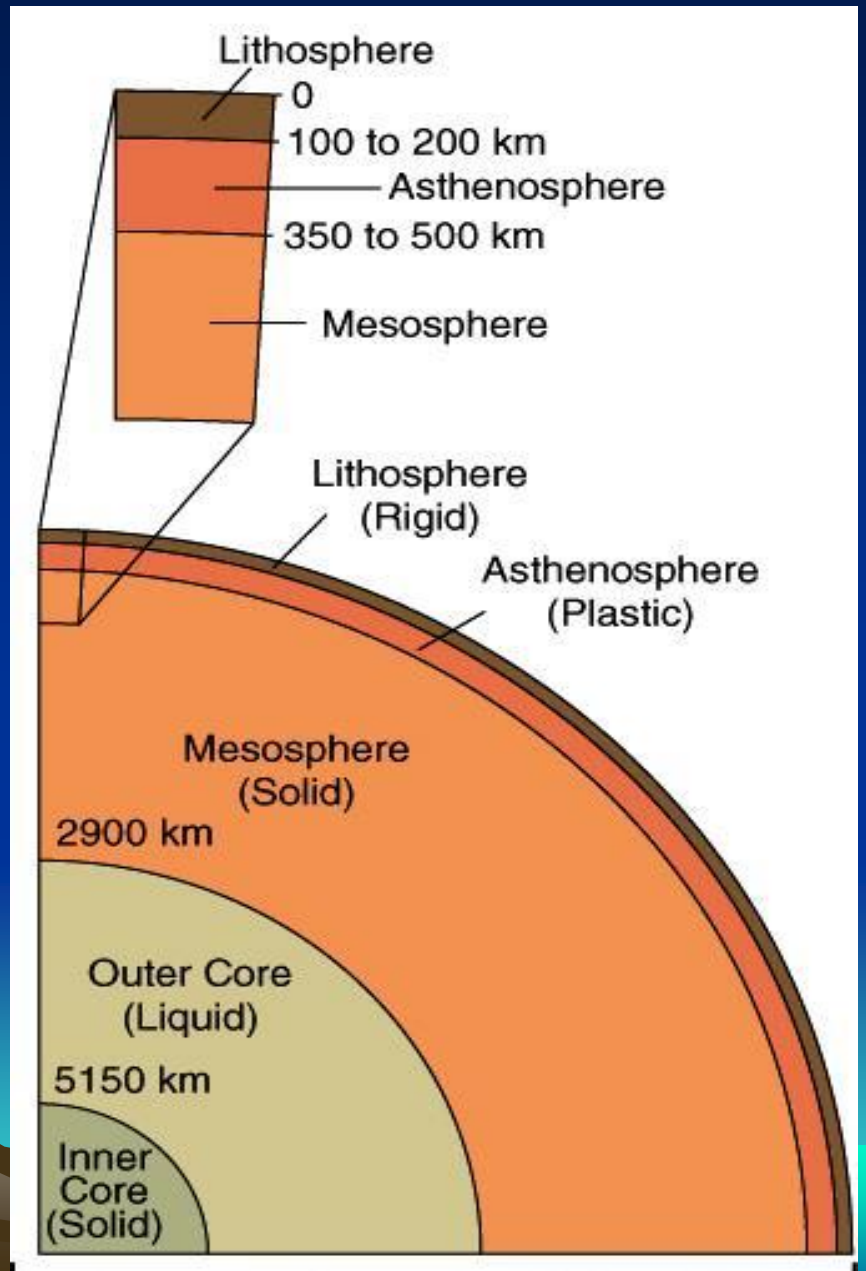
Higher pressure offsets higher temperatures

Outer Core

Liquid, Flow creates magnetic field

Inner Core

Solid



National Geographic: The Story of the Earth

- https://www.youtube.com/watch?v=SYOarZKipnU